Maximum Annual Cumulative for Control Structur Gate Installation plus Chute and Stilling Basin - Avg annual tons (During the year 2014: Chute and Stilling Basin annual average + 7 months of Gate Installation

Emissions - Cumulative Summary from all Activities **Exhaust Criteria Pollutants Borings for Approach Channel Cofferdam** (Oct 2010 through Jan 2011) Period of Operation (months) Mitigated **Worker Commute Emissions** (No mitigation Jnmitigat 0.094 8.90 0.010 0.00077 0.00046 0.00009 0.094 8.90 0.010 0.00077 0.00046 Mitigated (Enhanced Control Practices) **Construction Equipment Exhaust** 20% reduction in NO_x ; 45% reduction in PM_{10} Unmitigate NOx PM_{10} co CO NO_v PM₁₀ PM2.5 SO. co CO₂ PM2.5 SO Total annual average tons **Control Structure** (Jan 2011 through July 2014) Months of operation during Control Structure construction Total Period of Operation (months) 42 Excavation (months) 9 Gate installation (months) Aggregate and concrete 24 Worker Commute Emissions (Excavation, Concrete Placement, Gate Installation) Mitigated Unmitigated (No mitigations) CO NO. PM. PM. SO co CO NO PM. PM₂ ROG 70.41 Total Pounds 1,455.3 1,558.2 14.1 1,362,690.00 Total Ton 0.007 Average annual pound 33.60 20.12 389,340.00 415.8 Average annual ton 0.01 0.010 **Construction Equipment Exhaust** Mitigated (Enhanced Control Practices) 20% reduction in NO_x; 45% reduction in PM₁₀ Unmitigated PM_{10} ROG CO₂ ROG co CO NO_v PM_{10} PM2.5 SO NO. PM_2 CO Excavation - Average annual ton (Jan 2011 - Sept 2011; 9 months Concrete Placement - Average annual tons (Jul-15.16 13.09 0.49 0.49 1.95 15.1 10.47 0.27 0.2 1.9 2011 - July 2013; 24 months] Gate Installation - Average annual tons 5.59 4.20 0.13 0.13 0.69 5.59 3.3 0.072 0.07 0.69 (Dec 2013 - July 2014: 9 months) 1.23 0.84 0.023 0.023 0.14 1.23 0.67 0.013 0.013 0.14 Maximum Annual Cumulative - Avg. annual ton (During the year 2011: Excavation + 6 months concrete On-Site Haul Truck Mitigated (Enhanced Control Practices) Unmitigated CO CO NO. PM PM₁ SO. ROG co CO NO. PM PM_{2.5} SO. ROG Average annual tons (2011) 0.012 0.071 Off-Site Haul Truck Mitigated (No mitigations Jnmitigate co CO2 PM₁₀ PM_{2.5} SO ROG co CO_2 NO PM₁₀ PM_2 SO. ROG Average annual tons 0.088 0.0020 0.18 2.66 0.10 0.088 0.0020 0.18 Maximum Annual Cumulative - Avg. annual ton (During the year 2011) Chute and Stilling Basin (late 2013 through 2016) Period of Operation (months) 36 **Worker Commute Emissions** Unmitigated Mitigated (No mitigations) NOx NO. PM₁₀ Total Pounds 12.285.00 1.168.020.00 ..247.40 100.80 60.35 1.335.60 2.285.00 1.168.020.00 1.247.40 100.80 60.3 Total Ton 6.14 584.0 0.62 0.050 0.0060 6.14 584.01 0.006 0.6 0.030 0.67 0.050 0.030 Average annual pound 4,095.0 389,340 415.8 33.60 20.12 445.2 4,095.00 389,340.0 415.8 445.2 Average annual tons **Construction Equipment Exhaust** Unmitigate Mitigated (Enhanced Control Practices co CO NO_v PM_{10} PM2.5 so ROG co CO₂ NO, PM_{10} PM2.5 ROG Average annual tons Off-Site Haul Truck Unmitigated Mitigated (No mitigations) co CO NO PM. PM. so ROG CO CO NO PM. PM. so ROG Average annual tons 3.16 0.10 3.16 0.12 0.10 Total Annual Average Emissions

Emissions - Construction Equipment Exhaust

Note: No CO₂ Calculations in this worksheet

•				,	1			Unmitigated	Unmitigated		
	Number	Harris and day	Days per	Months			alculated 8-hour	Emissions	Emissions		Hamiltoniand Cationaland Annual Emissions (Annual
ype	Number	Hours per day	week	Months	<u> </u>	week Project	days per Project	(pounds) ROG CO NO _x PM ₁₀	ROG CO	NO _x PM ₁₀	Unmitigated Estimated Annual Emissions (tons) ROG CO NO _x PM ₁₀
ONTROL STRUCTURE - Concrete	Placement and	Batch Plant (24 i	months)		July 2011	through July 2013		noc co nox imio	NOC CO	x	1.00 CO 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0
emi-trailer truck	2		1 :	5 12		400 19,200	2,400	Off-site Haul Truck calculations			Off-site Haul Truck calculations
elly dump truck		8	1 3	3 16	9	96 6,144	768	Off-site Haul Truck calculations			Off-site Haul Truck calculations
anker trucks		2 4	1 3	3 16		24 1,536	192	Off-site Haul Truck calculations			Off-site Haul Truck calculations
hiller		1 10) :	5 17	-	50 2,400	300	624 5,133 3,852 117	0.31 2.57	7 1.93 0.059	0.31 2.57 1.93 0
ationary Cranes - electric		2 8	3	5 12		80 3,840 40 1,920	480	0 0 0 0 190 1,608 1,097 31.2	0 0	0 0 0 0	0 0 0 0.095 0.804 0.548 0
Ian lift/scissor lift - electric		2 4	2 1	5 17		80 3.840	240 480	190 1,608 1,097 31.2	0.095 0.80	0.55 0.016	0.095 0.804 0.348 0
/ater truck		1 4	1 5	5 17		20 960	120	53 266 324 19	0.03 0.13	0.16 0.009	0.027 0.133 0.16 0
reet sweeper		1 8	3	1 12	2	8 384	48	100 821 616 19	0.050 0.41		0.050 0.411 0.31 0.0
ckhammers		2 8	3	1 17		16 768	96	200 1,643 1,233 37	0.10 0.82		0.100 0.821 0.62 0
ement mixers (transit)		0 4	1 5	5 12	2	0 0	0	0 0 0 0	0.00 0.00		0.000 0.00 0.00
ont end loaders		2 8	3 5	5 8	8	80 2,560	320	208 1,715 1,286 38	0.10 0.86	0.64 0.019	0.104 0.858 0.643 0
atbed delivery truck		1						Off-site Haul Truck calculations			Off-site Haul Truck calculations
ontrol Structure Concrete Placem	ent Annual Av	erage Emissions									0.69 5.59 4.20
Control Structure Concrete Plac			months)								2011 0.34 2.80 2.10
Control Structure Concrete Plac	ement 2012 A	nnual Emissions (1	2 months)								2012 0.69 5.59 4.20
Control Structure Concrete Plac	ement 2013 A	nnual Emissions (6	months)								2013 0.34 2.80 2.10
NTROL STRUCTURE - Excavation uper" dump trucks	n (9 months)	-	January 20:	11 through	September	2011 200 4.800	600	On-site Haul Truck calculations			Off-site Haul Truck calculations
uper" dump trucks ater trucks		1	1	5 6	5	200 4,800	600	On-site Haul Truck calculations	0.013 0.07	7 0.08 0.005	0.013 0.07 0.08 0
el truck	-	1 :		5 5	В	10 320	40	18 89 108 6	0.009 0.04		0.013 0.07 0.08 0
aintenance truck		4	1	5 8	В	80 2,560	320	142 709 863 50	0.07 0.35		0.07 0.35 0.43 0
ckup trucks	1	0 4	1 5	5 8	8	200 6,400	800	54 509 59 4.3	0.027 0.25		0.027 0.25 0.029 0.0
rills for grouting - electric		6 8	,	5 9	9	240 8,640	1,080	0 0 0 0	0.00 0.00		0.00 0.00 0.00 0
ck drills for setting charges	N			E N	E NE		919	888 5,545 8,447 431	0.44 2.77		0.44 2.77 4.22 0
ont end loaders zers with rippers	-	2 8	5 5		5	80 2,560 80 2,560	320 320	208 1,715 1,286 38 464 3,824 2,867 86	0.10 0.86 0.23 1.91		0.10 0.86 0.64 0 0.23 1.91 1.43 0
zers with rippers ckhoes	-	4	1 1	5 6	R	160 2,560 160 5,120	640	464 3,824 2,867 86 416 3,430 2,573 77	0.23 1.91		0.23 1.91 1.43 0 0.21 1.72 1.29 0
chioca		-	1	1 3	2	80 2,560					0.21 1.72 1.29 0
raders		2	KI 5							1.64 0.045	
		3 8	3 5	5 3	3	120 1,440	320 180	563 4,794 3,270 90 655 5,573 3,802 104	0.28 2.40 0.33 2.79		0.33 2.79 1.90 0
rapers		2 8	3 3 5	5 5	3	-/				1.90 0.052	
crapers ccavators		2 8 3 8 2 8 2 8	3 5	5 5	3 3	120 1,440	180	655 5,573 3,802 104	0.33 2.79	9 1.90 0.052 5 1.07 0.029	0.33 2.79 1.90 0
raders crapers xcavators ompactor sheep foot		2 8 3 8 2 8 2 8 NE = Not Estima		5 5	3	120 1,440 80 1,600	180 200	655 5,573 3,802 104 368 3,128 2,134 58	0.33 2.79 0.18 1.56	9 1.90 0.052 5 1.07 0.029	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0
crapers xcavators ompactor sheep foot ontrol Structure Excavation Annu		issions (All in 2011	1)	5 5	3 3 3	120 1,440 80 1,600	180 200	655 5,573 3,802 104 368 3,128 2,134 58	0.33 2.79 0.18 1.56	9 1.90 0.052 5 1.07 0.029	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09
crapers xcavators		issions (All in 2011	1)	5 5 5	3 3 3	120 1,440 80 1,600	180 200	655 5,573 3,802 104 368 3,128 2,134 58	0.33 2.79 0.18 1.56	9 1.90 0.052 5 1.07 0.029	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0
crapers ccavators ompactor sheep foot ontrol Structure Excavation Annu otal Control Structure 2011 Emiss	ions (Excavation	issions (All in 2013 on plus Concrete F	l) Placement)	2013 through	gh July 2014	120 1,440 80 1,600 80 960	180 200	655 5,573 3,802 104 368 3,128 2,134 58	0.33 2.79 0.18 1.56	9 1.90 0.052 5 1.07 0.029	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09
rapers cavators impactor sheep foot introl Structure Excavation Annu stal Control Structure 2011 Emiss DINTROL STRUCTURE - Gate Instea ack driven cranes	ions (Excavation)	issions (All in 2013 on plus Concrete F	1)	2013 throug	gh July 2014	120 1,440 80 1,600 80 960	180 200	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17	0.33 2.79 0.18 1.56	3 1.90 0.052 5 1.07 0.029 4 0.30 0.0084	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09 2011 2.30 17.96 15.19 15.19
rapers cavators mpactor sheep foot montrol Structure Excavation Annu stal Control Structure 2011 Emiss DINTROL STRUCTURE - Gate Instea ack driven cranes	ions (Excavation)	issions (All in 2013 on plus Concrete F oths)	l) Placement)	2013 throug	3 5 5 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	120 1,440 80 1,600 80 960	180 200 120	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17	0.33 2.79 0.18 1.56 0.052 0.44	3 1.90 0.052 5 1.07 0.029 4 0.30 0.0084	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09 2011 2.30 17.96 15.19
crapers xcavators compactor sheep foot control Structure Excavation Annu otal Control Structure 2011 Emiss ONTROL STRUCTURE - Gate Insta rack driven cranes lat bed trucks	ions (Excavation)	issions (All in 2013 on plus Concrete F oths)	December 3	5 5	gh July 2014	120 1,440 80 1,600 80 960	180 200 120	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17	0.33 2.79 0.18 1.56 0.052 0.44	3 1.90 0.052 5 1.07 0.029 4 0.30 0.0084	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09 2011 2.30 17.96 15.19 0.144 1.227 0.837 0 Off-site Haul Truck calculations
crapers ccavators pmpactor sheep foot pentrol Structure Excavation Annu stal Control Structure 2011 Emiss DINTROL STRUCTURE - Gate Inste ack driven cranes	ions (Excavation)	issions (All in 2013 on plus Concrete F oths)	December 3	5 5	gh July 2014	120 1,440 80 1,600 80 960	180 200 120	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17	0.33 2.79 0.18 1.56 0.052 0.44	3 1.90 0.052 5 1.07 0.029 4 0.30 0.0084	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09 2011 2.30 17.96 15.19 15.19
rapers ccavators mmpactor sheep foot ontrol Structure Excavation Annu otal Control Structure 2011 Emiss ONTROL STRUCTURE - Gate Insta ack driven cranes at bed trucks	ions (Excavation)	issions (All in 2013 on plus Concrete F oths)	December 3	5 5	gh July 2014	120 1,440 80 1,600 80 960	180 200 120	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17	0.33 2.79 0.18 1.56 0.052 0.44	3 1.90 0.052 5 1.07 0.029 4 0.30 0.0084	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09 2011 2.30 17.96 15.19 0.144 1.227 0.837 0 Off-site Haul Truck calculations
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apers cavators mpactor sheep foot ntrol Structure Excavation Annu tal Control Structure 2011 Emiss INTROL STRUCTURE - Gate Insta tick driven cranes t bed trucks ntrol Structure Gate Installation UTE AND STILLING BASIN - Con mit-trailer truck ly dump truck	ions (Excavation) Illation (9 more) Annual Average	issions (All in 201: on plus Concrete F hths) Z	December :	s) 36 3 36	Late 2013	120 1,440 80 1,600 80 960 80 960 through 2016 400 57,600 96 13,824	200 120 200 120 200 200	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17 288 2,454 1,674 46 Off-site Haul Truck calculations Off-site Haul Truck calculations Off-site Haul Truck calculations	0.33 2.79 0.18 1.56 0.052 0.44 0.144 1.23	1.90 0.052 1.07 0.029 1 0.30 0.0084	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09 2011 2.30 17.96 15.19 0.144 1.227 0.837 0 Off-site Haul Truck calculations Off-site Haul Truck calculations Off-site Haul Truck calculations
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rapers cavators impactor sheep foot introl Structure Excavation Annu tal Control Structure 2011 Emiss DNTROL STRUCTURE - Gate Insta ack driven cranes it bed trucks introl Structure Gate Installation IUITE AND STILLING BASIN - Con mi-trailer truck illy dump truck inker trucks iller	ions (Excavation) Illation (9 more) Annual Average	issions (All in 201: on plus Concrete F hths) Z	December : December : B : The second of t	5) 5 36 3 36 5 36	Late 2013	120 1,440 80 1,600 80 960 80 960 1,600 80 960 1,600 through 2016 400 57,600 96 13,824 24 3,456 50 7,200	180 200 120 200 200 200 7,200 1,728 432 900	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17 288 2,454 1,674 46 Off-site Haul Truck calculations Off-site Haul Truck calculations Off-site Haul Truck calculations	0.33 2.79 0.18 1.56 0.052 0.44 0.144 1.23	1.90 0.052 1.107 0.029 1 0.30 0.0084 3 0.84 0.0230	0.33 2.79 1.90 0 0.18 1.56 1.07 0 0.052 0.44 0.30 0.0 2011 1.95 15.16 13.09 2011 2.30 17.96 15.19 0.144 1.227 0.837 0 Off-site Haul Truck calculations Off-site Haul Truck calculations Off-site Haul Truck calculations
rapers cavators cavators impactor sheep foot introl Structure Excavation Annu tal Control Structure 2011 Emiss oNTROL STRUCTURE - Gate Insta ack driven cranes at bed trucks introl Structure Gate Installation iUTE AND STILLING BASIN - Con mit-trailer truck illy dump truck nker trucks iiller attionary Cranes - electric	ions (Excavation) Illation (9 more) Annual Average	issions (All in 201: on plus Concrete F tths) 2 2 3 ge Emissions (Assumt and Batch Plan 0 4 8 4 2 4	December : December : B : The second of t	s) 5 36 3 36 3 36	Late 2013	120 1,440 80 1,600 80 960 80 960 through 2016 400 57,600 96 13,824 24 3,456 50 7,200 80 11,520	7,200 1,728 432 900 1,440	655 5,573 3,802 104 368 3,128 2,134 58 103 881 601 17 288 2,454 1,674 46 Off-site Haul Truck calculations Off-site Haul Truck calculations Off-site Haul Truck calculations 192 957 1,165 67 1,872 15,399 11,556 351 0 0 0 0	0.33 2.79 0.18 1.56 0.052 0.44 0.144 1.23 0.096 0.48 0.936 7.70 0 0 0	3 1.90 0.052 5 1.07 0.029 1 0.30 0.0084 3 0.84 0.0230 3 0.58 0.0337 5.78 0.1755 0 0 0	0.33 2.79 1.90 0
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BORINGS FOR APPROACH CHANNEL	COFFERDAM (4 moi	nths)	Lat	e 2010 - Early	2011															
Diesel & Hydraulic drill rig	1	10	5	4	50	800	100	97	603	919	47	0.048	0.3	30 0.4	46 0.0235		0.048	0.30	0.46	0.023
Flat bed trucks	2	4	5	4					Off-site Haul Tru	ck calculations						Off-si	ite Haul Tr	uck calculati	ons	
Borings for Approach Channel Annual	Average Emissions	Assume in 2010	0)														0.048	0.30	0.46	0.023

Construction Equipment Emission Rates (pounds per day) from Reclamation 2007

Equipment Type	ROG	со	NO _x	PM ₁₀
Bore/Drill Rigs				
2009	2.38	20.21	16.41	0.38
2010-2016	2.26	19.23	15.61	0.36
Paving Equipment				
2009	1.04	8.23	6.78	0.22
2010-2016	1.04	8.52	6.39	0.19
Rollers				
2009	0.86	7.34	5.01	0.14
2010-2016	0.86	7.34	5.01	0.14
Cranes				
2009	1.44	12.27	8.37	0.23
2010-2016	1.44	12.27	8.37	0.23
Crawler Tractors	•		•	
2009	1.45	11.55	9.5	0.31
2010-2016	1.45	11.95	8.96	0.27
Crushing/Proc Equipment		1		
2009	2.12	16.86	13.88	0.45
2010-2016	2.12	17.45	13.09	0.4
Rough Terrain Forklifts		25		2.11
2009	0.79	6.7	4.57	0.13
2010-2016	0.79	6.7	4.57	0.13
Rubber Tired Dozers	0., 5	5.7	-1.37	0.13
2009	3.66	29.13	23.97	0.78
2010-2016	3.66	30.14	22.61	0.68
Rubber Tired Loaders				
2009	1.35	11.52	7.86	0.22
2010-2016	1.35	11.52	7.86	0.22
Excavators				
2009	1.84	15.64	10.67	0.29
2010-2016	1.84	15.64	10.67	0.29
Graders		•		
2009	1.76	14.98	10.22	0.28
2010-2016	1.76	14.98	10.22	0.28
Off-Highway Tractors/Compactors				
2009	1.84	14.65	12.05	0.39
2010-2016	1.84	15.16	11.37	0.34
Scrapers				
2009	3.64	30.96	21.12	0.58
2010-2016	3.64	30.96	21.12	0.58
Skid Steer Loaders				
2009	0.56	4.78	3.26	0.09
2010-2016	0.56	4.78	3.26	0.09
Off-Highway Trucks/Water Trucks				
2009	3.6	30.62	20.89	0.58
2010-2016	3.6	30.62	20.89	0.58
Other Construction Equipment				
2009	2.08	16.54	13.61	0.44
2010-2016	2.08	17.11	12.84	0.39
Pavers				
2009	1.37	11.62	7.93	0.22
2010-2016	1.37	11.62	7.93	0.22
Surfacing Equipment	2.77	20.00	24.00	0.0
2009	3.77	29.99	24.68	0.8
2010-2016	3.77	31.03	23.28	0.7
Tractors/Loaders/Backhoes	0.65	امرح	4.3-1	0.00
2009	0.65	5.18	4.26	0.14
2010-2016	0.65	5.36	4.02	0.12
Trenchers	4.00	0.50	5.00	0.00
2009	1.00	8.53	5.82	0.16
2010-2016	1.00	8.53	5.82	0.16

Emission factors for ROG, CO, NOx, PM10 from (Reclamation 2007)

Assume: Emission rates from 2011 to 2016 are equal to 2010 Eight hour work day

Approximate 2010 annual unmitigated emissions: 0.05 0.30 0.023 Approximate 2011 annual unmitigated emissions: 2.30 17.96 15.19 0.55 Approximate 2012 annual unmitigated emissions 0.69 5.59 4.20 0.13 Approximate 2013 annual unmitigated emissions: 0.34 2.80 0.07 Approximate 2014 annual unmitigated emissions: 1.44 11.65 8.61 0.27 Approximate 2015 annual unmitigated emissions: 1.29 10.42 7.77 0.25 1.29 Approximate 2016 annual unmitigated emissions: 10.42

Construction Equipment Emission Rates (pounds per day) from Corps 2009

Equipment Type	ROG	co	NO_x	PM_{10}
Bore/Drill Rigs				
175 Horsepower	0.966	6.033	9.19	0.469
Pickups ¹				
Pounds/1,000 miles	1.12	10.6	1.22	0.0905
Pounds/day	0.0672	0.636	0.0732	0.00543
Heavy-heavy duty die	sel truck 20	09 ²		
Pounds per mile	0.00739	0.03694	0.04495	0.0026
Pounds/day	0.4434	2.2164	2.697	0.156

Project will use 140 hp drills

 $^{^{1}}$ Assume: Pickups in use 4 hours per day, maximum speed is 15 mph, maximum distance per day is 60 miles.

² Assume: Trucks in use 4 hours per day, maximum speed is 15 mph, maximum distance per day is 60 miles.

Appendix A-2: Exhaust Emissions - Haul Trucks

Emissions: On-Site and Off-Site Haul Trucks Exhaust

(Based on Vehicle Miles Traveled)

Assumptions and Emission Factors from: Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009)

ON-SITE HAUL TRUCKS

EMISSION FACTORS

			Emission 1	Rate in gran	s per mile		
Vehicle Description	CO	CO ₂	NO _x	PM 10	$PM_{2.5}$	SO _x	ROG
Heavy-Heavy Duty Diesel Truck 2009	16.75	2,516.08	20.39	1.18	1.05	0.02	3.35
Emission Factor from (Corps 2009) Appendix A: On-site Truck	Emissions						
			r r				

			Emission F	tate in poun	ds per mile		
Vehicle Description	co	CO ₂	NO _x	PM 10	$PM_{2.5}$	SO _x	ROG
Heavy-Heavy Duty Diesel Truck 2009	0.03693	5.5469	0.04495	0.00260	0.00231	0.0000441	0.00739
Emission Factor calculated based on conversion factor of 0.00220	346 to convert f	rom grams to p	ounds				

OFF-SITE HAUL TRUCKS

EMISSION FACTORS

			Emission R	ate in poun	ds per mile		
Vehicle Description	co	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SO _x	ROG
Heavy-Heavy Duty Diesel Truck 2009	0.010	4.21	0.040	0.00153	0.00132	0.0000301	0.00268

Emission Factor from (Corps 2009) Appendix A: Off-site Truck Emissions

CONTROL STRUCTURE - Excavation (9 months) Jan - Sept 2011

						Emissions	n pounds						Emissions i	n tons			
	Miles per	Number															
Vehicle	round trip	of trips	Total Miles	co	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SO _x	ROG	co	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SO _x	ROG
"Super" dump truck (hauling to MIAD)	3	6,400	19,200	709	106,501	863	50	44	0.85	142	0.35	53.25	0.43	0.025	0.022	0.00042	0.071
										•	•						

19,200

			Total Emiss	ions in ton	S		
	CO	CO ₂	NO _x	PM_{10}	PM _{2.5}	SOx	ROG
TOTAL ON-SITE HAUL TRUCK EMISSIONS	0.35	53.25	0.43	0.025	0.022	0.00042	0.071
Average annual on-site haul truck emissions (9 months):	0.35	53.25	0.43	0.025	0.022	0.00042	0.071

CONTROL STRUCTURE - Concrete Placement and Batch Plant (24 months) and Gate Intallation (9 months)

						Emissions i	in pounds						Emissions i	n tons			
	Miles per	Number															
Vehicle	trip	of trips	Total Miles	co	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SOx	ROG	co	CO ₂	NO_x	PM_{10}	$PM_{2.5}$	SOx	ROG
Off-site deliveries of material	10	230	2,300	23.0	9,683	92	3.5	3.0	0.069	6.16	0.0115	4.84	0.046	0.0018	0.0015	0.000035	0.003
Aggregate delivery for concrete	36	9,700	349,200	3,492.0	1,470,132	13,968	534	460.9	10.511	935.86	1.7460	735.07	6.98	0.2671	0.2305	0.0053	0.47
Delivery of reinforcing bars	10	66	660	6.6	2,779	26	1.0	0.9	0.020	1.77	0.0033	1.39	0.0132	0.0005	0.0004	0.000010	0.0009
Delivery of Bulkhead gates	30	6	180	1.8	758	7	0.3	0.2	0.005	0.48	0.0009	0.38	0.0036	0.00014	0.00012	0.000003	0.0002
Delivery of Taintor gates	30	6	180	1.8	758	7	0.3	0.2	0.005	0.48	0.0009	0.38	0.0036	0.00014	0.00012	0.000003	0.0002
Delivery of Trunion girders	30	6	180	1.8	758	7	0.28	0.24	0.005	0.48	0.0009	0.38	0.0036	0.00014	0.00012	0.0000027	0.00024
Delivery of stairs and handrails	30	3	90	0.90	379	4	0.14	0.12	0.0027	0.24	0.0005	0.19	0.0018	0.000069	0.000059	0.0000014	0.00012
Delivery of walkways, steel grating	30	5	150	1.5	632	6	0.23	0.20	0.0045	0.40	0.0008	0.32	0.0030	0.00011	0.00010	0.0000023	0.00020
Delivery of trunnion and guides	30	12	360	3.6	1,516	14	0.55	0.48	0.011	0.96	0.0018	0.76	0.0072	0.00028	0.00024	0.0000054	0.0004
Delivery of misc. electrical, HVAC	10	1,200	12,000	120.0	50,520	480	18.4	15.8	0.361	32.16	0.0600	25.26	0.2400	0.0092	0.0079	0.00018	0.016
Delivery for construction of batch plant	20	10	200	2.0	842	8	0.3	0.3	0.006	0.54	0.0010	0.42	0.0040	0.0002	0.0001	0.00000	0.000
Delivery of concrete from off-site source	20	41	820	8.2	3,452	33	1.3	1.1	0.025	2.20	0.0041	1.73	0.0164	0.0006	0.0005	0.00001	0.00:
Total				3,663.2	1,542,207.2	14,652.8	560.5	483.5	11.0	981.7	1.83	771.10	7.33	0.28	0.24	0.0055	0.49
Average Annual emissions (based on 33 mor	nths)			1,332.1	560,802.6	5,328.3	203.8	175.8	4.0	357.0	0.67	280.40	2.66	0.10	0.088	0.0020	0.18
		Miles	366,320														

Miles: 473,790

CHUTE AND STILLING BASIN - Concrete Place	ement and B	atch Plant/	Foundation Pre	paration/Back	fill (36 month:	s)		Late 2013 t	hrough 201	16							
						Emissions i	in pounds						Emissions i	in tons			
	Miles per	Number															
Vehicle	trip	of trips	Total Miles	co	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SOx	ROG	CO	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SO _x	ROG
Off-site deliveries of material	10	230	2,300	23.0	9,683	92	3.5	3.0	0.069	6.16	0.0115	4.84	0.046	0.0018	0.0015	0.000035	0.0031
Aggregate delivery for concrete	36	13,000	468,000	4,680.0	1,970,280	18,720	716	617.8	14.087	1,254.24	2.3400	985.14	9.36	0.3580	0.3089	0.0070	0.63
Delivery of reinforcing bars	10	169	1,690	16.9	7,115	68	2.6	2.2	0.051	4.53	0.0085	3.56	0.0338	0.0013	0.0011	0.000025	0.0023
Delivery of misc. electrical, HVAC	10	100	1,000	10.0	4,210	40	1.5	1.3	0.030	2.68	0.0050	2.11	0.0200	0.0008	0.0007	0.00002	0.001
Delivery of concrete from off-site source	20	40	800	8.0	3,368	32	1.2	1.1	0.024	2.14	0.0040	1.68	0.0160	0.0006	0.0005	0.00001	0.001
Total				4,737.9	1,994,655.9	18,951.6	724.9	625.4	14.3	1,269.8	2.37	997.33	9.48	0.36	0.31	0.0071	0.63
Average Annual emissions (based on 36 mor	nths)			1.579.3	664.885.3	6.317.2	241.6	208.5	4.8	423.3	0.79	332.44	3.16	0.12	0.10	0.0024	0.21

TOTAL PROJECT OFF-SITE MILES (69 months) July 2011 through 2016					Total Emiss	ions in tons	د		
			co	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SOx	ROG
TOTAL OFF-SITE MILES:	840,110	TOTAL OFF-SITE HAUL TRUCK EMISSIONS:	4.2	1,768.4	16.8	0.64	0.55	0.0126	1.13
Average annual off-site truck miles (based on 69 months, or 5.75 years)	146.106	Average annual off-site haul truck emissions (69 months, or 5.75 years):	0.73	307.55	2.92	0.11	0.10	0.0022	0.20

Emissions - Worker Commute Exhaust

Assumptions and Emission Factors from: Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009) **Emission Factor** from (Corps 2009)

	Emission Rate in Pounds Per 1000 Miles							
Vehicle Description	CO	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SO _x	ROG	
Light Duty Automobile (LDA)	8.87	832	0.756	0.0694	0.0393	0.00786	0.991	
Light Duty Truck (LDT)	10.6	1020	1.22	0.0905	0.0566	0.0131	1.12	
Average based on 50 percent LDA and 50 percent LDT	9.75	927	0.99	0.08	0.0479	0.00959	1.06	

Control Structure

a. C	
Workers	70
Workers per vehicle	2
Commuter vehicles per day	35
Vehicles from Sacramtento (80%)	28
Vehicles from Folsom (20%)	7
Roundtrip to Sacramento (miles)	60
Roundtrip to Folsom (miles)	10

Daily Miles: 1,750 Annual Miles: 420,000 COMMUTER MILES (42 months) 1,470,000 COMMUTER MILES (42 months)/1000 1470

(lan	2011	through	luly	2014)
(Jaii	2011	unougn	July	2017)

(,,,,	
Period of Operation (months)	42
Workdays per week	5
Workdays per month	20
Workdays in period	840

Operation (months) ¹	
Excavation	9
Aggregate and concrete	24
Gate installation	9
_	42
¹ Assume no overlan	

36

5

20

720

Emissions	co	CO ₂	NO _x	PM_{10}	$PM_{2.5}$	SO_x	ROG
Total Pounds	14,332.50	1,362,690.00	1,455.30	117.60	70.41	14.10	1,558.20
Total Tons	7.17	681.35	0.73	0.059	0.035	0.0070	0.78
Average annual pounds	4,095.00	389,340.00	415.80	33.60	20.12	4.03	445.20
Average annual tons	2.05	194.67	0.21	0.017	0.010	0.0020	0.22

Chute and Stilling Basin

(late 2013 through 2016) Period of Operation (months)

Workdays per week

Workdays in period

Workdays per month

Workers	70
Workers per vehicle	2
Commuter vehicles per day	35
Vehicles from Sacramtento (80%)	28
Vehicles from Folsom (20%)	7
Roundtrip to Sacramento (miles)	60
Roundtrip to Folsom (miles)	10

Daily Miles: 1,750 Annual Miles: 420,000 COMMUTER MILES (36 months) 1,260,000 COMMUTER MILES (36 months)/1000 1,260

Emissions	co	CO_2	NOx	PM_{10}	PM _{2.5}	SO _x	ROG
Total Pounds	12,285.00	1,168,020.00	1,247.40	100.80	60.35	12.08	1,335.60
Total Tons	6.14	584.01	0.62	0.050	0.030	0.0060	0.67
Average annual pounds	4,095.00	389,340.00	415.80	33.60	20.12	4.03	445.20
Average annual tons	2.05	194.67	0.21	0.017	0.010	0.0020	0.22

Borings for Approach Channel Cofferdam

(Oct 2010 through Jan 2011)

pproudit charmer correraum		(Oct 2010 till ough Jan 2011)	
Workers	4	Period of Operation (months)	4
Workers per vehicle	1	Workdays per week	5
Commuter vehicles per day	4	Workdays per month	20
Vehicles from Sacramtento (100%)	4	Workdays in period	80
Vehicles from Folsom (0%)	0		
Roundtrip to Sacramento (miles)	60		
Roundtrip to Folsom (miles)	10		

Daily Miles: 240 Annual Miles: 19,200 COMMUTER MILES (4 months) 19,200 COMMUTER MILES (4 months)/1000 19.2

Emissions	CO	CO_2	NO _x	PM_{10}	PM _{2.5}	SO _x	ROG
Pounds	187.20	17,798.40	19.01	1.54	0.92	0.18	20.35
Tons	0.094	8.90	0.010	0.00077	0.00046	0.000092	0.010

Total Commuter Emissions	CO	CO ₂	NO _x	PM_{10}	PM _{2.5}	SO _x	ROG
	26,804.70	2,548,508.40	2,721.71	219.94	131.69	26.36	2,914.15
	13.40	1,274.25	1.36	0.110	0.066	0.013	1.46

Total Commuter Vehicle Miles Traveled

2,749,200

Fugitive Dust - Cumulative Activities

PM₁₀ and Fugitive Dust Pollutants **Borings for Approach Channel Cofferdam** (Oct 2010 through Jan 2011) Period of Operation (months) Based on AP-42 Table 11.9-4 TSP Emissions = 1.3 pounds per hole Assume: 100% TSP = PM₁₀; 15 borings Tons per year Inmitigated Mitigated 0.00975 Total annual average tons **Control Structure** (Jan 2011 through July 2014) Period of Operation (months) Excavation: 9 months - January through September, 2011 Aggregate and Concrete: 24 months - July 2011 through July 2013 Gate Installation: 9 months - December 2013 through July 2014 Mitigated (55 % reduction) **Excavation Cut and Fill** (Basic Construction Emission Control Practices) (Urbemis 2007) Tons per year Paved Road - Haul Truck Mitigated (no mitigations) $PM_{2.5}$ Paved Road - Worker Commuter Travel Unmitigated Mitigated (no mitigations) Tons per year Unpaved Road - Haul Truck Tons per year Material Storage Pile Handling - Excavation Tons per year Material Storage Pile Handling - Aggregate Unmitigated Stockpile Wind Erosion - Excavation Inmitigated Tons per year Stockpile Wind Erosion - Aggregate Tons per year Blasting (with Drilling) Unmitigated Concrete Batch Plant Unmitigated Mitigated Tons per year Total Avg Tons per year (Control Structure) (late 2013 through 2016) **Chute and Stilling Basin** Period of Operation (months) Paved Road - Haul Truck Paved Road - Worker Commuter Travel Unmitigated Mitigated (no mitigations) Tons per year Material Storage Pile Handling - Excavation¹ Unmitigated Mitigated (90% reduction) 0.0025 0.00038 Material Storage Pile Handling - Aggregate Tons per year 0.00055 0.000083 0.0055 0.00083 Stockpile Wind Erosion - Aggregate Concrete Batch Plant Unmitigated

Total Avg Tons per year (Chute and Stilling Basin)

¹ Although excavation is not planned during the chute and stilling basin construction phase, PM ₁₀ emissions are listed to give the most conservative estimate.

Appendix A-2: Fugitve Dust - Paved Roads

FUGITIVE DUST Emissions: Paved Roads

Methodology from AP-42 , Fifth Edition, Volume 1 Chapter 13.2.1: Paved Roads

Assumptions and Emission Factors from Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009)
VMT = Vehicle Miles Traveled

Assumptions for Worker Commuter Travel based on Corps 2009.

Worker commuter fleet is 50 percent light duty automobile (LDA) and 50 percent light duty truck (LDT). Average Vehicle Weight (W) is 1.75 tons.

<u>Roadway</u> <u>Surface Type</u>		PM ₁₀ Particulate Emission Factor (lb/VMT)	PM ₁₀ Long-Term Particulate Emission Factor (lb/VMT)	PM25 Particulate Emission Factor (Ib/VMT)	PM> CLong-Term Particulate Emission Factor (lb/VMT)
Freeway	0.235	<0	<0	<0	<0
Arterial/Major street	0.587	0.000044	0.0000413	<0	<0
Collector Road	0.072	0.000044	0.0000413	<0	<0
Local Road	0.052	0.0017	0.00159	<0	<0
Rural Road	0.054	0.0057	0.00534	0.000565	0.00053

Note: AP-42 , Fifth Edition, Volume 1 Chapter 13.2.1, page 13.2.1-5 states "There may be situations where low silt loading and/or low average weight will yield calculated negative emisions. If this occurs, the emissions calculated from the equation should be set to zero.

Fugitive Dust Annual Emission Calculations for Worker Commuter Travel.

Maximum annual commuter miles traveled: 420,000
*Both Control Structure and Chute and Stilling Basin

*January 2011 through 2016

Total commuter miles traveled for entire project: 2,749,200

Roadway surface	Annual VMT (miles)	Annual PM ₁₀ Emissions (ton/year)	Annual PM ₁₀ Annual Long- Term Emissions (ton/year)	Annual PM _{2.5} Emissions (ton/year)	Annual PM _{2.5} Annual Long- Term Emissions (ton/year)
Freeway	98,700	0	0	0	0
Arterial/Major street	246,540	0.0054	0.0051	0	0
Collector Road	30,240	0.00067	0.00062	0	0
Local Road	21,840	0.019	0.017	0	0
Rural Road	22,680	0.065	0.061	0.0064	0.0060
Totals:		0.089	0.084	0.006	0.0060

Assumptions for Heavy Heavy Diesel Truck Travel based on Corps 2009.

Average Vehicle Weight (W) is 23.25 tons.

			PM ₁₀ Long-Term	PM _{2.5}	PM _{2.5} Long-Term
Roadway		PM ₁₀ Particulate	Particulate	Particulate	Particulate
Surface	Travel	Emission Factor	Emission Factor	Emission Factor	Emission Factor
Type	Fraction	(Ib/VMT)	(lb/VMT)	(lb/VMT)	(lb/VMT)
Freeway	0.235	0.02	0.02	0.00224	0.0021
Arterial/Major street	0.587	0.02	0.02	0.00337	0.00317
Collector Road	0.072	0.02	0.02	0.00337	0.00317
Local Road	0.052	0.1	0.1	0.02	0.01
Rural Road	0.054	0.3	0.28	0.04	0.04

Note: Long-term particulate emission factor considers natural mitigation with precipitation.

CONTROL STRUCTURE - Fugitive Dust Annual Emission Calculations for Off-Site Truck Travel
Total off-site truck miles: 366,320 Months:
Average annual off-site truck miles: 133,207

33

			Annual PM ₁₀		Annual PM _{2.5}
	Annual	Annual PM ₁₀	Annual Long-	Annual PM _{2.5}	Annual Long-
Roadway	VMT	Emissions	Term Emissions	Emissions	Term Emissions
surface	(miles)	(ton/year)	(ton/year)	(ton/year)	(ton/year)
Freeway	31,304	0.31	0.31	0.035	0.033
Arterial/Major street	78,193	0.78	0.78	0.13	0.12
Collector Road	9,591	0.10	0.10	0.016	0.015
Local Road	6,927	0.35	0.35	0.07	0.035
Rural Road	7,193	1.08	1.01	0.14	0.144
		2.62	2.54	0.40	0.35

Notes: Total off-site truck miles calculated on "On-Site and Off-Site Haul Trucks Exhaust" page
Assumes 24 months for concrete placement and 9 months for gate installation.

 CHUTE and STILLING BASIN - Fugitive Dust Annual Emission Calculations for Off-Site Truck Travel
 71

 Total off-site truck miles:
 473,790
 Months:
 36

 Average annual off-site truck miles:
 157,930
 Months:
 36

Roadway surface	Annual VMT (miles)	Annual PM ₁₀ Emissions (ton/year)	Annual PM ₁₀ Annual Long- Term Emissions (ton/year)	Annual PM _{2.5} Emissions (ton/year)	Annual PM _{2.5} Annual Long- Term Emissions (ton/year)
Jarrace					
Freeway	37,114	0.37	0.37	0.042	0.039
Arterial/Major street	92,705	0.93	0.93	0.16	0.15
Collector Road	11,371	0.11	0.11	0.019	0.018
Local Road	8,212	0.41	0.41	0.08	0.041
Rural Road	8,528	1.28	1.19	0.17	0.17
		3.10	3.02	0.47	0.42

Notes: Total off-site truck miles calculated on "On-Site and Off-Site Haul Trucks Exhaust" page

Appendix A-2: Fugitve Dust - Unpaved Roads

FUGITIVE DUST Emissions: Unpaved Roads

Methodology from AP-42, Fifth Edition, Volume 1 Chapter 13.2.2: Unpaved Roads
Assumptions and Emission Factors from: Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009)
VMT = Vehicle Miles Traveled

Assumptions for Heavy Heavy Diesel Truck Travel based on Corps 2009.

Average Vehicle Weight (W) is 23.25 tons.

		PM ₁₀ Long-Term		PM _{2.5} Long-Term
	PM ₁₀	Particulate		Particulate
	Particulate	Emission Factor		Emission Factor
	Emission	[Naturally	PM _{2.5} Particulate	[Naturally
	Factor	Mitigated]	Emission Factor	Mitigated]
	(lb/VMT)	(lb/VMT)	(lb/VMT)	(lb/VMT)
Unpaved Road	2.76	2.08	0.28	0.21

Note: Long-term particulate emission factor considers natural mitigation with precipitation.

Fugitive Dust Annual Emission Calculations for On-Site Truck Travel during excavation.

Nine months on-site truck miles: 19,200 (excavation hauling to MIAD)

	(chearation	madning to ivin tb)			
	(Cricava alon	Unmitigated	Annual PM ₁₀ Annual Long- Term Emissions	Unmitigated	Annual PM _{2.5} Annual Long- Term Emissions
	Annual	Annual PM ₁₀	[Naturally	Annual PM _{2.5}	[Naturally
Roadway	VMT	Emissions	Mitigated]	Emissions	Mitigated]
surface	(miles)	(ton/year)	(ton/year)	(ton/year)	(ton/year)
Unpaved Road	19,200	26.50	19.97	2.69	2.02

55 percent control factor for road dust for watering twice a day. Mitigated emission:

8.9856

0.9072

MIAD Mormon Island Auxiliary Dam (disposal and course material stockpiling for U.S. Army Corps of Engineers).

FUGITIVE DUST Emissions: Excavated Material Storage Piles

Methodology from AP-42, Fifth Edition, Volume 1 Chapter 13.2.4: Aggregate Handling and Storage Piles
Assumptions and Emission Factors from: Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009)

Assumptions for Excavation Stockpile Handling Emissions based on Corps 2009.

Mean wind speed (mph)	5.1
Material moisture content (%)	7.9
Density of weathered granite (lb/cy)	1,850
Wet suppression controls (%)	90

Emission factor for PM_{10} stockpile emissions (lb/ton):	0.000168
Emission factor for PM _{2.5} stockpile emissions (lb/ton):	0.0000254

mph = miles per hour % = percent lb/cy = pounds per cubic yard lb/ton = pounds per ton

Fugitive Dust Emission Calculations for Excavation Stockpile Handling

Period of Excavation (months):	9
Common Excavation (cy) ¹ :	20,000
Rock Excavation (cy) ¹ :	300,000
Total Excavation (cy) ¹ :	320,000
Stockpile amount (tons):	296,000

	Stockpile	Emission	Emission	Unmitigated	Mitigated
	Amount	Factor	Controls	emissions	emissions
Parameter	(tons)	(lb/ton)	(percent)	(tons/year)	(tons/year)
PM ₁₀	296,000	0.000168	90	0.025	0.0025
PM _{2.5}	296,000	0.0000254	90	0.0038	0.00038

 $^{^{\}mathrm{1}}$ Based on Folsom Dam JFP Teleconference Notes, Air Analysis Revisions, June 8, 2010

Assumptions: The excavated material will be added to the storage pile during construction of the Control Structure.

The excavated material will still be in place during the Chute and Stilling Basin construction phase.

FUGITIVE DUST Emissions: Aggregate Material Storage Piles (for concrete batch plants)

Methodology from AP-42, Fifth Edition, Volume 1 Chapter 13.2.4: Aggregate Handling and Storage Piles
Assumptions and Emission Factors from: Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009)

Assumptions for Excavation Stockpile Handling Emissions based on Corps 2009.

Fugitive Dust Emission Calculations for Aggregate Stockpile Handling

Mean wind speed (mph)	5.1
Material moisture content (%)	7.9
Density of weathered granite (lb/cy)	1,850
Wet suppression controls (%)	90

Control Structure Concrete Emplacement (months):	24
Chute and Stilling Basin Concrete Emplacement (months):	36
Total Control Structure Aggregate (cy) ¹ :	97,000
Total Chute and Stilling Basin Aggregate (cy) ² :	211,068
Entire Project Length - Total Aggregate (cy):	308,068

Annual Control Structure Aggregate (cy): 48,500
Annual Chute and Stilling Basin Aggregate (cy): 70,356

Emission factor for PM_{10} stockpile emissions (lb/ton): 0.000168 Emission factor for $PM_{2.5}$ stockpile emissions (lb/ton): 0.0000254

Entire Project Length - Total Aggregate (tons): 284,963

Annual Control Structure Aggregate (tons): 44,863
Annual Chute and Stilling Basin Aggregate (tons): 65,079

Chute and Stilling Basin

mph = miles per hour % = percent

lb/cy = pounds per cubic yard
lb/ton = pounds per ton

Para
PM
PM:

	Annual					Annual					
	Stockpile	Emission	Emission	Unmitigated	Mitigated	Stockpile	Emission	Emission	Unmitigated	Mitigated	
	Amount	Factor	Controls	emissions	emissions	Amount	Factor	Controls	emissions	emissions	
Parameter	(tons)	(lb/ton)	(percent)	(tons/year)	(tons/year)	(tons)	(lb/ton)	(percent)	(tons/year)	(tons/year)	
PM ₁₀	44,863	0.000168	90	0.0038	0.00038	65,079	0.000168	90	0.0055	0.00055	
PM _{2.5}	44,863	0.0000254	90	0.00057	0.000057	65,079	0.0000254	90	0.00083	0.000083	

¹ Based on March 5, 2010, equipment list spreadsheet (equipmentjfrMarch 5.xls)

Control Structure

² Based on June 15, 2010, email attachment from Jane Rinck to Garrett Smith and Leroy Shaser (commentary.docx).

FUGITIVE DUST Emissions: Excavated Stockpile Wind Erosion

Methodology from AP-42 , Fifth Edition, Volume 1 Chapter 13.2.5: Industrial Wind Erosion

Assumptions and Emission Factors from: Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009)

Emission Factor (EF) in g/m² =
$$k \sum_{i=1}^{N} P_i$$

Where:

k = Particle Size Multiplier (dimensionless)

N = Number of Disturbances per Year

P_i = Erosion Potential Corresponding to the Observed Fasted Mile of Wind for the ith Period Between Disturbances

Assumptions for Stockpile Wind Erosion Emissions based on Corps 2009.

k for PM ₁₀	0.5
k for PM _{2.5}	0.075
P _i : Erosion Potential (g/m ²)	7.37
Wet suppression controls (%)	90

cy = cubic yards

g = gram

m = meter

% = percent

Fugitive Dust Emission Calculations for Stockpile Wind Erosion

Period of Excavation (months):	9
Workdays per Month:	20
Total workdays:	180
N = Number of Disturbances (assume one per workday)	180
Total Material Excavated and Stored: (cy) ¹ :	320,000
Total Material Excavated and Stored: (cubic m) ² :	244,659

$PM_{10} EF (g/m^2) =$	663.3
$PM_{2.5} EF (g/m^2) =$	99.495

Stockpile Area	(sa	m) ³ :	24	,465.9

	Emission Factor	Stockpile	Emission Controls	Unmitigated emissions	Mitigated emissions	Unmitigated emissions ⁴	Mitigated emissions ⁴
Parameter	(g/m²)	Area (m²)	(percent)	(g/year)	(g/year)	(tons/year)	(tons/year)
PM ₁₀	663.3	24,465.9	90	16,228,245	1,622,824	17.9	1.79
PM _{2.5}	99.50	24,465.9	90	2,434,237	243,424	2.68	0.27

¹ Based on Project Description

² Conversion Factor: Cubic Yard * 0.76456 = Cubic Meter

³ Assume Stockpile is 10 Meters Deep

⁴ Conversion Factor: Grams*0.0000011023 = Ton

FUGITIVE DUST Emissions: Aggregate Stockpile Wind Erosion (for concrete batch plants)

Methodology from AP-42, Fifth Edition, Volume 1 Chapter 13.2.5: Industrial Wind Erosion
Assumptions and Emission Factors from: Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009)

Emission Factor (EF) in g/m² =
$$k \sum_{i=1}^{N} P_i$$

Where:

k = Particle Size Multiplier (dimensionless)

N = Number of Disturbances per Year

P_i = Erosion Potential Corresponding to the Observed Fasted Mile of Wind for the ith Period Between Disturbances

Assumptions for Stockpile Wind Erosion Emissions based on Corps 2009.

Fugitive Dust Emission Calculations for Stockpile Wind Erosion

k for PM ₁₀	0.5
k for PM _{2.5}	0.075
P _i : Erosion Potential (g/m ²)	7.37
Wet suppression controls (%)	90

: 24	Control Stucture Concrete Placement (months):
: 36	Chute and Stilling Basin Concrete Placement (months):
97,000	Total Control Structure Aggregate (cy) ^a
48,500	Annual - Control Structure Aggregate (cy)
37,081	Annual - Control Structure Aggregate (cubic m) ¹
211,068	Total Chute and Stilling Basin Aggregate (cy) ^b
70,356	Annual - Chute and Stilling Basin Aggregate (cy)
53,791	Annual - Chute and Stilling Basin Aggregate (cubic m) ¹
•	

Annual Workdays: 240
Annual Workdays: 240
N = Assume one disturbance per workday

 $PM_{10} EF (g/m^2) =$ 884.4 $PM_{2.5} EF (g/m^2) =$ 132.7

Annual Control Structure Stockpile Area²: 3,708 square meter
Annual Chute and Stilling Basin Stockpile Area²: 5,379 square meter

cy = cubic yards
g = gram
m = meter
% = percent

				Control Structure			
	Emission	Annual	Emission	Unmitigated	Mitigated	Unmitigated	Mitigated
	Factor	Stockpile	Controls	emissions	emissions	emissions ⁴	emissions ⁴
Parameter	(g/m ²)	Area (m²)	(percent)	(g/year)	(g/year)	(tons/year)	(tons/year)
PM ₁₀	884.4	3,708.1	90	3,279,458	327,946	3.6	0.36
PM _{2.5}	132.66	3,708.1	90	491,919	49,192	0.54	0.054

	Chute and Spilling Basin										
Parameter	Emission Factor (g/m²)	Stockpile	Emission Controls (percent)	Unmitigated emissions (g/year)	Mitigated emissions (g/year)	Unmitigated emissions ⁴ (tons/year)	Mitigated emissions ⁴ (tons/year)				
PM ₁₀	884.4	5,379.1	90	4,757,310	475,731	5.2	0.52				
PM _{2.5}	132.66	5,379.1	90	713,596	71,360	0.79	0.079				

^a Based on March 5, 2010, equipment list spreadsheet (equipmentjfrMarch 5.xls)

¹ Conversion Factor: Cubic Yard * 0.76456 = Cubic Meter

² Assume Stockpile is 10 Meters Deep

³ Conversion Factor: Grams*0.0000011023 = Ton

^b Based on June 15, 2010, email attachment from Jane Rinck to Garrett Smith and Leroy Shaser (commentary.docx)

FUGITIVE DUST Emissions: Concrete Batch Plant

Methodology and Assumptions from AP-42 , Fifth Edition, Volume 1 Chapter 11.12: Concrete Batching

Emission Factors from AP-42 11.12 Concrete Batching

PM₁₀ emissions in pounds per ton of concrete:

Batch Plant Source	Uncontrolled	Controlled
Aggregate transfer	0.0033	ND
Sand transfer	0.00099	ND
Cement unloading to elevated storage silo (pneumatic)	0.46	0.00034
Cement supplement unloading to elevated storage silo (pneumatic)	1.10	0.0049
Weigh hopper loading	0.0024	ND
Mixer loading (central mix)	0.134	0.0048
Truck loading (truck mix)	0.278	0.016
Total	1.98	0.033

Note: Controlled Total is calculated by adding data from "Controlled" column with data from "Uncontrolled" column when "Controlled" is ND.

One cubic yard of concrete (lbs) 4,024

ND = No Data cy = cubic yards

Fugitive Dust Emission Calculations for Control Structure

Period of Batch Plant Operation (months):	24
Aggregate (cy)	97,000
Concrete Placement (cy) ¹ :	97,234
Concrete Placement (tons):	195,635

		Unmitigated	Controlled	Unmitigated	Controlled
	Annual Concrete	emissions	emissions	emissions	emissions
Parameter	Placement (tons)	(pounds/year)	(pounds/year)	(tons/year)	(tons/year)
PM ₁₀	97,817	193,550	3,202	97	1.6

¹ Based on Project Description

Fugitive Dust Emission Calculations for Chute and Stilling Basin

Period of Batch Plant Operation (months):	36
Aggregate (cy)	211,068
Concrete Placement -Chute (cy):	99,625
Concrete Placement -Stilling Basin (cy):	28,295
Concrete Placement -Total (cy):	127,920
Concrete Placement (tons):	257,375

		Unmitigated	Controlled	Unmitigated	Controlled
	Annual Concrete	emissions	emissions	emissions	emissions
Parameter	Placement (tons)	(pounds/year)	(pounds/year)	(tons/year)	(tons/year)
PM ₁₀	85,792	169,755	2,808	84.9	1.4

Appendix A-2: Fugitve Dust - Cut and Fill (Excavation)

Urbemis 2007 Version 9.2.4

Detail Report for Annual Construction Unmitigated Emissions (Tons/Year)

File Name: F:\I-drive\G018 Sacramento\Workfiles\Urbemis\Folsom_Control_Structure1_06-11-10.urb924

Project Name: Folsom Dam Control Structure Excavation

Project Location: Sacramento County AQMD

On-Road Vehicle Emissions Based on: Version: Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	<u>CO2</u>
2011	0.00	0.00	0.00	0.00	18.36	0.00	18.36	3.83	0.00	3.83	0.00
Mass Grading 01/17/2011-	0.00	0.00	0.00	0.00	18.36	0.00	18.36	3.83	0.00	3.83	0.00
Mass Grading Dust	0.00	0.00	0.00	0.00	18.36	0.00	18.36	3.83	0.00	3.83	0.00
Mass Grading Off Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Mass Grading 1/17/2011 - 9/16/2011 - Folsom Dam Control Structure Excavation

Total Acres Disturbed: 0

Maximum Daily Acreage Disturbed: 0 Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 1777.78 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

FUGITIVE DUST Emissions: Blasting and Associated Drilling

Blasting Methodology from Blue Rock Quarry Draft Environmental Impact Report (Sonoma County 2005)

Equation:

$$EF = 0.2 * 961 (A)^{0.8} / [(D)^{1.8} (M)^{1.9}]$$

Where:

EF = Emission Factor

A= Blast Area

D= Depth of Blast

M= Moisture Content

Two blast sizes would be used during excavation: 50% of excavation with a blast volume of 2,778 cubic yards and 50% of excavation with a blast volume of 1,389 cubic yards. Assume 300,000 total cubic yards of excavation. Information: Blasting dimensions provided by Kim Jorgensen in email to Garrett Smith (March 18, 2010)

Blast size #1 (2,778 cubic yards)

Fugitive Dust from Blast

Depth of Blast (ft)	20
Moisture content of material (%)	2
Blast Area (sq ft)	3,750
Number of blasts:	54
Number of holes per blast:	150

Emission Factor=	169.

Total Emissions (lbs)	9,152.95
Total Emissions (tons)	4.58

Fugitive Dust from Drilling

Emission factor (lbs/hole)	1.3

Total Emissions (lbs)	10,530.0
Total Emissions (tons)	5.27

Depth of approximately 20 feet Moisture content from (Corps 2009) Appendix A: Blasting Emissions Assumes 75 feet wide (wall) by 50 feet burden

Total number of holes: 8,100

Cubic yards: 150,012

pounds per blast

 PM_{10} PM_{10}

TSP: Methodology from AP-42, Table 11.9-4

TSP (Most Conservative Assumption: Assume 100% TSP is PM₁₀)

Unmitigated Total PM ₁₀ from Blasting (tons)	9.83
Mitigated Total PM_{10} from Blasting(tons)	6.3
Unmitigated Total PM ₁₀ from Drilling (tons)	10.53
Mitigated Total PM ₁₀ from Drilling (tons)	4.7

Unmitigated Total PM₁₀ from Blasting and Drilling (tons)

Mitigated Total PM₁₀ from Blasting and Drilling (tons)

Blast size #2 (1,389cubic yards)

Emission Factor=

Fugitive Dust from Blast

Depth of Blast (ft)	20
Moisture content of material (%)	2
Blast Area (sq ft)	1,875
Number of blasts:	108
Number of holes per blast:	75

Ellinosioli i detel	37.33
	,
T . I	40 540 00

Total Emissions (lbs)	10,513.98	
Total Emissions (tons)	5.26	

Fugitive Dust from Drilling

Emission factor (lbs/hole)	1.3

Total Emissions (lbs)	10,530.0
Total Emissions (tons)	5.27

Depth of approximately 20 feet

Moisture content from (Corps 2009) Appendix A: Blasting Emissions Assumes 75 feet wide (wall) by 25 feet burden

Cubic yards: 150,012

Total number of holes: 8,100

pounds per blast

 PM_{10} PM₁₀

TSP: Methodology from AP-42, Table 11.9-4

TSP (Most Conservative Assumption: Assume 100% TSP is PM_{10})

Assume 36% control efficiency (Folsom Dam Safety and Flood Damage Reduction Early Approach Channel Excavation Final EA/IS (Corps 2009))

Assume 55% reduction from soil disturbance activities (SMAQMD, 2009))

GHG Emissions - Cumulative Summary from all Activities

Unmitigated Carbon Dioxide Emissions

Borings for Approach Channel Cofferdam

(Oct 2010 through Jan 2011) Period of Operation (months)

Worker Commute Emissions

CO_2	
Average annual	Average annual
tons	metric tons
8.9	8.1

Construction Equipment Exhaust

CO ₂	
Average annual	Average annual
tons	metric tons
56	51

Summation 65 59

Control Structure

(Jan 2011 through July 2014)

Period of Operation (months)

Worker Commute Emissions (Both Excavation and Concrete Emplacement)

CO ₂	
Average annual	Average annual
tons	metric tons
195	177

Construction Equipment Exhaust

	CO_2	
	Average annual	Average annual
	tons	metric tons
Excavation	3,382	3,068
Concrete Placement and Batch Plant	1,064	965
Gate Installation	90	81

On-Site Haul Truck

 CO2
 Average annual tons
 Average annual metric tons

 Excavation
 53
 48

Off-Site Haul Truck

CO_2	
Average annual	Average annual
tons	metric tons
280	254

Concrete Batch Plant

CO ₂	
Average annual	Average annual
tons	metric tons
13,111	11,895

17,021

Summation: Maximum average annual emissions

 $\label{eq:Value calculated using Control Structure Excavation CO_2\ emissions for construction equipment\ exhaust.$

36

(late 2013 through 2016)

Period of Operation (months)

Worker Commute Emissions

Chute and Stilling Basin

CO_2	
Average annual	Average annual
tons	metric tons
405	477

Construction Equipment Exhaust

CO ₂	
Average annual	Average annual
tons	metric tons
2.591	2.351

Off-Site Haul Truck

CO_2	
Average annual	Average annual
tons	metric tons
332	301

Concrete Batch Plant

CO_2	
Average annual	Average annual
tons	metric tons
11,499	10,432

Summation 14.617

Carbon dioxide emission values derived from other calculation spreadsheets and copied to this summary sheet.

GHG Emissions: Concrete Batch Plant

Emission Factor from Flowers and Sanjayan, 2007 (Abstract): "Green House Gas Emissions Due to Concrete Manufacture,
The International Journal of Life Cycle Assessment. Vol 12, Number 5, July 2007. Landsberg, Germany: Ecomed.

320
244.7
121.6
1.3079
0.76456
4.024
,,== :

cy = cubic yards

Carbon Dioxide Emission Calculations for Control Structure

Period of Batch Plant Operation (months):	24
Aggregate (cy)	97,000
Concrete Placement (cy) ¹ :	97,234
Concrete Placement (tons):	195,635

				CO ₂ emissions	
	Annual Concrete	Emission Factor	CO ₂ emissions	(metric	CO ₂ emissions
Parameter	Placement (tons)	(kg/ton)	(kg/year)	tons/year)	(tons/year)
CO ₂	97,817	121.6	11,894,596	11,895	13,111

¹ Based on Project Description

Carbon Dioxide Emission Calculations for Chute and Stilling Basin

Period of Batch Plant Operation (months):	36
Aggregate (cy)	211,068
Concrete Placement -Chute (cy):	99,625
Concrete Placement -Stilling Basin (cy):	28,295
Concrete Placement -Total (cy) ² :	127,920
Concrete Placement (tons):	257,375

				CO ₂ emissions	
	Annual Concrete	Emission Factor	CO ₂ emissions	(metric	CO ₂ emissions
Parameter	Placement (tons)	(kg/ton)	(kg/year)	tons/year)	(tons/year)
CO ₂	85,792	121.6	10,432,268	10,432	11,499

 $^{^2}$ Based on June 15, 2010, email attachment from Jane Rinck to Garrett Smith and Leroy Shaser (commentary.docx).

GHG Emissions - Construction Equipment Exhaust

				Unmitigated		
<u>Equipment</u>		Days per	Hours per Hours per Calculated 8-hour	CO ₂ Emission Emissions		
Туре	Number Hours per d	lay week Months	week Project days per Project	Factor (grams)	Total Unmitigated CO ₂ Emissions	Unmitigated Estimated Annual Emissions*
CONTROL STRUCTURE - Concrete F	Name and Batch Blant	24 Months	July 2011 through July 2013	(g/hr) CO ₂	Kilograms Metric Tons Tons	Kilograms Metric Tons Tons *Assume emissions spread out over 24 months
Semi-trailer truck	20	4 5 12	400 19,200 2,40	0 Off-site Haul Truck calculations		*Assume emissions spread out over 24 months
Belly dump truck	8	4 3 16	96 6,144 76	8 Off-site Haul Truck calculations		
Tanker trucks	2	4 3 16	24 1,536 19.			
Chiller	1	10 5 12	50 2,400 30 80 3,840 48		276,770 276.77 305.08	138,385 138 15
Stationary Cranes - electric Forklifts	2	8 5 12 4 5 12	80 3,840 48 40 1,920 24		223,447 223.45 246.31	111,724 112 12
Man lift/scissor lift - electric	2	8 5 12	80 3,840 48		0 0 0	0 0
Water truck	1	4 5 12	20 960 12		272,035 272.04 299.86	136,018 136 156
Street sweeper Jackhammers	1 2	8 1 12 8 1 12	8 384 4: 16 768 9		44,283 44.28 48.81 88.566 88.57 97.63	22,142 22 24 44,283 44 49
Cement mixers (transit)	0	4 5 12		0 115,321 88,506,259	0 0.00 0.00	0 0 0
Front end loaders	2	8 5 8	80 2,560 32		60,066 60.07 66.21	30,033 30 3:
Flatbed delivery truck	1	5		Off-site Haul Truck calculations		
Control Structure Concrete Placem	ant England				965,168 965 1,064	482,584 483 533
Control Structure Concrete Placem	ant Emissions				965,168 965 1,064	482,584 483 53.
CONTROL STRUCTURE - Excavation	ı (9 months)	Jan - Sept 2011				
"Super" dump trucks	5	8 5 6	200 4,800 60			
Water trucks	1	4 5 6	20 480 6		136,018 136.02 149.93	136,018 136 15
Fuel truck Maintenance truck	1 4	2 5 8	10 320 4 80 2,560 32		36,903 36.90 40.68 295.221 295.22 325.42	36,903 37 4: 295,221 295 32:
Pickup trucks	10	4 5 8	200 6,400 80		738,052 738.05 813.55	738,052 738 81-
Drills for grouting - electric	6	8 5 9	240 8,640 1,08		0 0.00 0.00	0 0 0
Rock drills for setting charges	NE NE	NE NE NE	NE 7,353 91	9 63,991 470,527,220	470,527 470.53 518.66	470,527 471 51
Front end loaders	2	8 5 8	80 2,560 32		60,066 60.07 66.21	60,066 60 60
Dozers with rippers Backhoes	2	8 5 8	80 2,560 32 160 5.120 64		539,593 539.59 594.79 120.133 120.13 132.42	539,593 540 59 120,133 120 13
Graders	4	8 5 8	160 5,120 64 80 2,560 32		266,476 266.48 293.74	120,133 120 13. 266,476 266 29
Scrapers	3	8 5 3	120 1,440 18		209,948 209.95 231.43	209,948 210 23
Excavators	2	8 5 5	80 1,600 20		169,633 169.63 186.99	169,633 170 18
Compactor sheep foot	2	8 5 3	80 960 12	0 26,757 25,686,566	25,687 25.69 28.31	25,687 26 29
Control Structure Excavation Emiss	NE = Not Es ions	timated			3,068,257 3,068 3,382	3,068,257 3,068 3,38
Track driven cranes	llation (9 months)	December 2013 through Ju 8 5 5	so 1,600 20	0 50,874 81,399,088	81,399 81.40 89.73	81,399 81 9
Flat bed trucks		8 3 3	80 1,600 20	Off-site Haul Truck calculations	81,399 81.40 89.73	81,399 81 9
Control Structure Gate Installation	Emissions				81,399 81 90	81,399 81 90
CHUTE AND STILLING BASIN - Cond	rete Placement and Batch P		te 2013 through 2016			
Semi-trailer truck	20	4 5 36	400 57,600 7,20			
Belly dump truck Tanker trucks	8	4 3 36	96 13,824 1,72 24 3,456 43		398,548 398.55 439.32	
Chiller			24 3,430 43			
	1	4 3 36 10 5 36	50 7.200 90	115.321 830.308.680		132,849 133 144 276,770 277 30
Stationary Cranes - electric	1 2	4 3 36 10 5 36 8 5 36	50 7,200 90 80 11,520 1,44		830,309 830.31 915.25 0 0.00 0.00	132,849 133 140 276,770 277 300 0 0 0
Stationary Cranes - electric Forklifts	1 2 2 2	10 5 36 8 5 36 4 5 36	80 11,520 1,44 40 5,760 72	0 0 0 0 116,379 670,341,254	830,309 830.31 915.25 0 0.00 0.00 670,341 670.34 738.92	276,770 277 309 0 0 0 223,447 223 244
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric	1 2 2 2 2	10 5 36 8 5 36 4 5 36 8 5 36	80 11,520 1,44 40 5,760 72 80 11,520 1,44	0 0 0 0 116,379 670,341,254 0 0 0	830,309 830.31 915.25 0 0.00 0.00 670,341 670.34 738.92 0 0.00 0.00	276,770 277 300 0 0 0 223,447 223 244 0 0 0
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck	2 1 2 2 2 2 2	10 5 36 8 5 36 4 5 36 8 5 36 4 5 36 4 5 36	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816.11 899.59	276,770 277 300 0 0 0 223,447 223 241 0 0 0 272,035 272 300
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper	2 1 2 2 2 2 1 1	10 5 36 8 5 36 4 5 36 8 5 36 4 5 36 8 1 36	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 1,152 14	0 0 0 0 0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 115,321 132,849,389	830,309 830,31 915,25 0 0,000 0,00 670,341 670,34 738,92 0 0,00 0,00 816,106 816,11 899,59 132,849 132,85 146,44	276,770 277 300 0 0 0 0 223,447 223 244 0 0 0 0 272,035 272 300 44,283 44 44
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers	2 1 2 2 2 2 1 1 1 2	10 5 36 8 5 36 4 5 36 8 5 36 4 5 36 4 5 36	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 1,152 14 16 2,304 28	0 0 0 0 0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 115,321 132,849,389	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816.11 899.59	276,770 277 300 0 0 0 223,447 223 241 0 0 0 272,035 272 300
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper	2	10 5 36 8 5 36 4 5 36 8 5 36 4 5 36 8 1 36 8 1 36	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 1,152 14 16 2,304 28	0 0 0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 4 115,321 122,849,389 8 115,321 265,698,778 115,321 0 23,463 270,298,714	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738.92 0 0.00 0.00 816,106 816,11 899.59 132,849 132,85 146,44 265,699 265,70 292,88	276,770 277 30 0 0 0 223,447 223 24 0 0 0 1 272,035 272 30 44,283 44 44 88,566 89 99
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit)	2 0	10 5 36 8 5 36 4 5 36 8 5 36 4 5 36 8 1 36 8 1 36 8 1 36	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 11,52 14 16 2,304 28 0 0	0 0 0 0 0 0 0 116,379 670,341,254 0 0 283,370 816,105,715 4 115,321 132,849,389 8 115,321 265,698,778 0 115,321 0	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00	276,770 277 30 0 0 0 0 223,447 223 244 0 0 0 272,035 272 300 44,283 44 44 88,566 89 99
Stationary Cranes - electric Forkiffs Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck	2 0 2 1	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 1,152 14 16 2,304 28 0 0 0 1 80 11,520 1,44	0 0 0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 4 115,321 122,849,389 8 115,321 265,698,778 115,321 0 23,463 270,298,714	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00	276,770 277 30 0 0 0 0 223,447 223 244 0 0 0 272,035 272 300 44,283 44 44 88,566 89 99
Stationary Cranes - electric Forkilits Man lift/scisor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four	2 0 2 1	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 1,152 14 16 2,304 28 0 0 0 80 11,520 1,444 te 2013 through 2016	0 0 0 116,379 670,341,254 0 0 0 0 283,370 816,105,715 1 115,321 132,849,389 115,321 265,698,778 0 123,463 270,298,714 Off-site Haul Truck calculations	830,099 830,31 915,25 0 0,00 0,00 670,341 670,34 738,92 0 0,00 0,00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0,00 0,00 270,299 270,30 297,95	276,770 277 30 0 0 0 223,447 223 24 0 0 0 272,035 272 30 44,283 44 44 88,566 89 99 0 0 0 90,100 90 99
Stationary Cranes - electric Forkilfts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck	2 0 2 1	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 1,152 14 16 2,304 28 0 0 0 1 80 11,520 1,44	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,688,778 0 123,463 270,298,714 Off-site Haul Truck calculations	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00	276,770 277 30 0 0 0 0 223,447 223 244 0 0 0 272,035 272 300 44,283 44 44 88,566 89 99
Stationary Cranes - electric Forkilfts Man Ilfryscissor lift - electric Water truck Street sweeper Jackhammers Cement mikers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Full truck Water truck Water truck Front end loader	2 0 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10	80 11,520 1,440 40 5,760 72 80 11,520 1,44 20 2,880 36 8 11,52 14 16 2,304 28 0 0 0 0 80 11,520 1,44 te 2013 through 2016 10 1,440 18 20 2,880 36 20 2,880 36	0 0 0 0 0 0 116,379 670,341,254 0 0 283,370 816,105,715 0 15,321 132,849,389 115,321 132,849,389 115,321 265,698,778 0 123,463 270,298,714 Off-site Haul Truck calculations	830,309 830,31 915,25 0 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,757 67,57 74,49	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 272,035 272 30 44,283 44 4 4 88,566 89 99 0 0 0 6 90,100 90 99
Stationary Cranes - electric Forkilfts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks	2 0 2 1	10	80 11,520 1,440 40 5,760 72 80 11,520 1,444 20 2,880 36 8 8 1,152 144 16 2,304 28 0 0 0 1 80 11,520 1,444 te 2013 through 2016 10 1,440 188 20 2,880 36 20 2,880 36 100 14,400 1,80	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 115,321 122,849,389 115,321 265,698,778 115,321 272,493,319 23,463 270,298,714 23,463 270,298,714 23,463 270,298,714 23,463 270,298,714 23,463 270,298,714 23,463 270,298,714 20,478,278,278,278,278,278,278,278,278,278,2	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738.92 0 0.00 0.00 815,106 815,11 899.59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899.59 67,775 67,57 74,49 1,660,617 1,660,62 1,830,50	276,770 277 30 0 0 0 223,447 223 24 0 0 0 1 272,035 272 30 44,283 44 44 88,566 89 9 0 0 0 0 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 55,5353 554 61
Stationary Cranes - electric Forkilits Man lift/Scisor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes	2 0 0 2 1 1 1 1 1 1 1 5 5 2 2	10	80 11,520 1,44 40 5,760 72 80 11,520 1,444 20 2,880 36 8 8 1,152 144 16 2,304 28 0 0 0 1,520 1,444 te 2013 through 2016 20 2,880 36 20 2,880 36 20 1,440 180 20 1,440 180 20 1,440 1,80 40 3,840 48	0 0 0 0 0 0 0 116,379 0 0 0 0 128,370 816,105,715 0 0 283,370 816,105,715 0 115,321 132,849,389 115,321 265,698,778 0 123,463 270,298,714 0 0 23,463 270,298,714 0 0 15,321 166,061,736 283,370 816,105,715 0 23,463 67,574,678 0 15,321 1,660,617,360 15,321 1,660,617,360 15,321 1,960,6	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,575 67,57 74,49 1,660,617 1,660,62 1,830,50 195,358 195,36 215,34	276,770 277 30 0 0 0 0 223,447 223 244 0 0 0 0 272,035 272 300 44,283 44 44 44 88,566 89 99 0 0 0 0 90,100 90 99 55,354 55 66 272,035 272 300 22,525 23 22 553,539 554 611 97,679 98 100
Stationary Cranes - electric Forkilfts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Truck die loader Pickup trucks Track driven cranes Drills for grouting - electric	2 0 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10	80 11,520 1,440 40 5,760 72 80 11,520 1,444 20 2,880 36 8 1,152 144 16 2,304 28 0 0 0 0 80 11,520 1,444 te 2013 through 2016 20 2,880 36 10 1,440 18 20 2,880 36 100 14,400 1,80 40 3,840 48 240 2,3400 2,888	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,688,778 0 123,463 270,298,714 0 153,211 166,061,736 283,370 816,105,715 23,463 675,574,678 115,321 1,660,61,736 0 283,370 816,105,715 23,463 675,574,678 115,321 1,660,617,360 50,874 195,357,811 0 0 0 0	830,309 830,31 915,25 0 0,00 0,00 670,341 670,34 738,92 0 0,00 0,00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0,00 0,00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,757 67,57 74,49 1,660,621 1,660,62 1,830,50 195,358 195,36 215,34 0 0,00 0,00	276,770 277 30 0 0 0 223,447 223 24 0 0 0 1 272,035 272 30 44,283 44 44 88,566 89 9 0 0 0 0 90,100 90 91 55,354 55 6 272,035 272 30 22,525 23 22 553,539 554 61 97,679 98 10
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mikers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers	2 0 0 2 1 1 1 1 1 1 1 5 5 2 2	10	80 11,520 1,44 40 5,760 72 80 11,520 1,444 20 2,880 36 8 8 1,152 144 16 2,304 28 0 0 0 1,520 1,444 te 2013 through 2016 20 2,880 36 20 2,880 36 20 1,440 180 20 1,440 180 20 1,440 1,80 40 3,840 48	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,688,778 0 123,463 270,298,714 0 153,211 166,061,736 283,370 816,105,715 23,463 675,574,678 115,321 1,660,61,736 0 283,370 816,105,715 23,463 675,574,678 115,321 1,660,617,360 50,874 195,357,811 0 0 0 0	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,575 67,57 74,49 1,660,617 1,660,62 1,830,50 195,358 195,36 215,34 0 0.00 0.00 221,416 221,42 244,07	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 0 272,035 272 30 44,283 44 44 88,566 89 99 0 0 0 0 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 553,539 554 611 97,679 98 100 0 0 0 221,416 221 24
Stationary Cranes - electric Forkilifts Man ilft/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Tront end loader Pickup trucks Track driven cranes Drills for grouting - electric	2 0 0 2 1 1 1 1 1 1 1 5 5 2 2	10	80 11,520 1,440 40 5,760 72 80 11,520 1,444 20 2,880 36 8 1,152 144 16 2,304 28 0 0 0 0 80 11,520 1,444 te 2013 through 2016 20 2,880 36 10 1,440 18 20 2,880 36 100 14,400 1,80 40 3,840 48 240 2,3400 2,888	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,688,778 0 123,463 270,298,714 0 153,211 166,061,736 283,370 816,105,715 23,463 675,574,678 115,321 1,660,61,736 0 283,370 816,105,715 23,463 675,574,678 115,321 1,660,617,360 50,874 195,357,811 0 0 0 0	830,309 830,31 915,25 0 0,00 0,00 670,341 670,34 738,92 0 0,00 0,00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0,00 0,00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,757 67,57 74,49 1,660,621 1,660,62 1,830,50 195,358 195,36 215,34 0 0,00 0,00	276,770 277 30 0 0 0 223,447 223 24 0 0 0 1 272,035 272 30 44,283 44 44 88,566 89 9 0 0 0 0 90,100 90 91 55,354 55 6 272,035 272 30 22,525 23 22 553,539 554 61 97,679 98 10
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mikers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers	2 0 0 2 1 1 1 1 1 1 1 5 5 2 2	10	80 11,520 1,440 40 5,760 72 80 11,520 1,444 20 2,880 36 8 1,152 144 16 2,304 28 0 0 0 0 80 11,520 1,444 te 2013 through 2016 20 2,880 36 10 1,440 18 20 2,880 36 100 14,400 1,80 40 3,840 48 240 2,3400 2,888	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,688,778 0 123,463 270,298,714 0 153,211 166,061,736 283,370 816,105,715 23,463 675,574,678 115,321 1,660,61,736 0 283,370 816,105,715 23,463 675,574,678 115,321 1,660,617,360 50,874 195,357,811 0 0 0 0	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,575 67,57 74,49 1,660,617 1,660,62 1,830,50 195,358 195,36 215,34 0 0.00 0.00 221,416 221,42 244,07	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 0 272,035 272 30 44,283 44 44 88,566 89 99 0 0 0 0 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 553,539 554 611 97,679 98 100 0 0 0 221,416 221 24
Stationary Cranes - electric Forkilfts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers	2 0 0 2 1 1 1 1 1 1 1 5 5 2 2	10	80 11,520 1,440 40 5,760 72 80 11,520 1,444 20 2,880 36 8 1,152 144 16 2,304 28 0 0 0 0 80 11,520 1,444 te 2013 through 2016 20 2,880 36 10 1,440 18 20 2,880 36 100 14,400 1,80 40 3,840 48 240 2,3400 2,888	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,688,778 0 123,463 270,298,714 0 153,211 166,061,736 283,370 816,105,715 23,463 675,574,678 115,321 1,660,61,736 0 283,370 816,105,715 23,463 675,574,678 115,321 1,660,617,360 50,874 195,357,811 0 0 0 0	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,575 67,57 74,49 1,660,617 1,660,62 1,830,50 195,358 195,36 215,34 0 0.00 0.00 221,416 221,42 244,07	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 0 272,035 272 30 44,283 44 44 88,566 89 99 0 0 0 0 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 553,539 554 611 97,679 98 100 0 0 0 221,416 221 24
Stationary Cranes - electric Forkilfts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers Chute and Stilling Basin Emissions	2 0 2 1 1 1 1 1 1 1 1 5 2 2 6 6 2 2	10	80 11,520 1,444 40 5,760 72 80 11,520 1,444 20 2,880 36 8 11,52 144 16 2,304 28 0 0 0 80 11,520 1,444 te 2013 through 2016 20 2,880 36 20 2,880 36 100 14,440 18 20 2,880 36 20 1,380 36 20 1,380 36 20 1,380 36 20 2,380 36	0 0 116,379 670,341,254 0 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,688,778 0 123,463 270,298,714 0 153,211 166,061,736 283,370 816,105,715 23,463 675,574,678 115,321 1,660,61,736 0 283,370 816,105,715 23,463 675,574,678 115,321 1,660,617,360 50,874 195,357,811 0 0 0 0	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,575 67,57 74,49 1,660,617 1,660,62 1,830,50 195,358 195,36 215,34 0 0.00 0.00 221,416 221,42 244,07	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 0 272,035 272 30 44,283 44 44 88,566 89 99 0 0 0 0 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 553,539 554 611 97,679 98 100 0 0 0 221,416 221 24
Stationary Cranes - electric Forkilits Man lift/Scisor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Front end loader Pickup trucks Track driven cranes Orillis for grouting - electric Portable cement mixers Chute and Stilling Basin Emissions BORINGS FOR APPROACH CHANNI BORINGS FOR APPROACH CHANNI BORINGS FOR APPROA	2 0 0 2 1 1 1 1 1 1 1 1 5 5 2 6 6 2 2 EL COFFERDAM (4 months)	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 11,52 14 16 2,304 28 0 0 0 0 8 11,520 1,44 20 2,880 36 10 1,520 1,44 20 2,880 36 20 2,880 36 10 1,440 18 20 2,880 36 10 1,440 1,320 24 24 240 23,040 2,88	0 0 0 0 0 0 116,379 0 0 0 283,370 816,005,715 1 15,321 132,849,389 115,321 221,415,648 0 0 0 0 0 0 0 115,321 221,415,648	830,09 830,31 915,25	276,770 277 30 0 0 0 223,447 223 244 0 0 0 1 272,035 272 300 44,283 44 44 88,566 89 9 0 0 0 9 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 22,525 23 22 553,539 554 611 97,679 98 100 0 0 0 1 221,416 221 224
Stationary Cranes - electric Forkilfts Man liftyScissor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers Chute and Stillling Basin Emissions BORINGS FOR APPROACH CHANNI Diesel & Hydraulic drill rig	2 0 2 1 1 1 1 1 1 1 1 5 2 2 6 6 2 2	10	80 11,520 1,444 40 5,760 72 80 11,520 1,444 20 2,880 36 8 11,52 144 16 2,304 28 0 0 0 80 11,520 1,444 te 2013 through 2016 20 2,880 36 20 2,880 36 100 14,440 18 20 2,880 36 20 1,380 36 20 1,380 36 20 1,380 36 20 2,380 36	0 0 116,379 670,341,254 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,698,778 0 23,463 270,298,714 Off-site Haul Truck calculations 115,321 166,061,736 283,370 816,105,715 23,463 67,574,678 15,321 15,321 166,061,736 0 283,370 816,105,715 0 23,463 67,574,678 115,321 1,660,617,360 0 50,874 195,357,811 0 0 0 115,321 221,415,648	830,309 830,31 915,25 0 0.00 0.00 670,341 670,34 738,92 0 0.00 0.00 816,106 816,11 899,59 132,849 132,85 146,44 265,699 265,70 292,88 0 0.00 0.00 270,299 270,30 297,95 166,062 166,06 183,05 816,106 816,11 899,59 67,575 67,57 74,49 1,660,617 1,660,62 1,830,50 195,358 195,36 215,34 0 0.00 0.00 221,416 221,42 244,07	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 0 272,035 272 30 44,283 44 44 88,566 89 99 0 0 0 0 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 553,539 554 611 97,679 98 100 0 0 0 221,416 221 24
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mikers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers Chute and Stilling Basin Emissions BORINGS FOR APPROACH CHANNI Diesel & Hydraulic drill rig Flat bed trucks	2 0 1 1 1 1 1 1 1 1 1	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 11,52 14 16 2,304 28 0 0 0 0 8 11,520 1,44 20 2,880 36 10 1,520 1,44 20 2,880 36 20 2,880 36 10 1,440 18 20 2,880 36 10 1,440 1,320 24 24 240 23,040 2,88	0 0 0 0 0 0 116,379 0 0 0 283,370 816,005,715 1 15,321 132,849,389 115,321 221,415,648 0 0 0 0 0 0 0 115,321 221,415,648	830,309 830,31 915,25	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 1 272,035 272 30 44,283 44 44 44 88,566 89 9 9 0 0 0 6 90,100 90 99 55,354 55 6 272,035 272 30 22,525 23 22 22,525 23 22 553,539 554 61 97,679 98 100 0 0 0 0 221,416 221 24 2,350,598 2,351 2,59
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mikers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers Chute and Stilling Basin Emissions BORINGS FOR APPROACH CHANNI Diesel & Hydraulic drill rig Flat bed trucks	2 0 1 1 1 1 1 1 1 1 1	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 11,52 14 16 2,304 28 0 0 0 0 8 11,520 1,44 20 2,880 36 10 1,520 1,44 20 2,880 36 20 2,880 36 10 1,440 18 20 2,880 36 10 1,440 1,320 24 24 240 23,040 2,88	0 0 116,379 670,341,254 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,698,778 0 23,463 270,298,714 Off-site Haul Truck calculations 115,321 166,061,736 283,370 816,105,715 23,463 67,574,678 15,321 15,321 166,061,736 0 283,370 816,105,715 0 23,463 67,574,678 115,321 1,660,617,360 0 50,874 195,357,811 0 0 0 115,321 221,415,648	830,09 830,31 915,25	276,770 277 30 0 0 0 223,447 223 244 0 0 0 1 272,035 272 300 44,283 44 44 88,566 89 9 0 0 0 9 90,100 90 99 55,354 55 66 272,035 272 30 22,525 23 22 22,525 23 22 553,539 554 611 97,679 98 100 0 0 0 1 221,416 221 224
Stationary Cranes - electric Forkilfts Man lifty/Scisor lift - electric Water truck Street sweeper Jackhammers Cement mixers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers Chute and Stillling Basin Emissions BORINGS FOR APPROACH CHANNI Diesel & Hydraulic drill rig	2 0 1 1 1 1 1 1 1 1 1	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 11,52 14 16 2,304 28 0 0 0 0 8 11,520 1,44 20 2,880 36 10 1,520 1,44 20 2,880 36 20 2,880 36 10 1,440 18 20 2,880 36 10 1,440 1,320 24 24 240 23,040 2,88	0 0 116,379 670,341,254 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 225,698,778 0 23,463 270,298,714 Off-site Haul Truck calculations 115,321 166,061,736 283,370 816,105,715 0 23,463 67,574,678 1 15,321 1,660,617,360 0 15,321 1,660,617,360 0 15,321 1,660,617,360 0 115,321 1,660,617,360 0 115,321 1,660,617,360 0 115,321 221,415,648	830,309 830,31 915,25	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 1 272,035 272 30 44,283 44 44 44 88,566 89 9 9 0 0 0 6 90,100 90 99 55,354 55 6 272,035 272 30 22,525 23 22 22,525 23 22 553,539 554 61 97,679 98 100 0 0 0 0 221,416 221 24 2,350,598 2,351 2,59
Stationary Cranes - electric Forklifts Man lift/scissor lift - electric Water truck Street sweeper Jackhammers Cement mikers (transit) Front end loaders Flatbed delivery truck CHUTE AND STILLING BASIN - Four Fuel truck Water truck Front end loader Pickup trucks Track driven cranes Drills for grouting - electric Portable cement mixers Chute and Stilling Basin Emissions BORINGS FOR APPROACH CHANNI Diesel & Hydraulic drill rig Flat bed trucks	2 0 1 1 1 1 1 1 1 1 1	10	80 11,520 1,44 40 5,760 72 80 11,520 1,44 20 2,880 36 8 11,52 14 16 2,304 28 0 0 0 0 8 11,520 1,44 20 2,880 36 10 1,520 1,44 20 2,880 36 20 2,880 36 10 1,440 18 20 2,880 36 10 1,440 1,320 24 24 240 23,040 2,88	0 0 116,379 670,341,254 0 0 283,370 816,105,715 14 115,321 132,849,389 115,321 265,698,778 0 23,463 270,298,714 Off-site Haul Truck calculations 115,321 166,061,736 283,370 816,105,715 23,463 67,574,678 15,321 15,321 166,061,736 0 283,370 816,105,715 0 23,463 67,574,678 115,321 1,660,617,360 0 50,874 195,357,811 0 0 0 115,321 221,415,648	830,309 830,31 915,25	276,770 277 30 0 0 0 1 223,447 223 244 0 0 0 1 272,035 272 30 44,283 44 44 44 88,566 89 9 9 0 0 0 6 90,100 90 99 55,354 55 6 272,035 272 30 22,525 23 22 22,525 23 22 553,539 554 61 97,679 98 100 0 0 0 0 221,416 221 24 2,350,598 2,351 2,59

Construction Equipment GHG Emission Rate (grams per hour) from Corps 2009

F	M 110	60	
Equipment Type (2009) Bore/Drill Rigs	Max HP	CO ₂	
	175	63,991.19	Project will use 140 hp drill
Paving Equipment	250	55,470.42	
Rollers			
	120	26,756.84	
Cranes	250	50,874.43	
Crawler Tractors	750	210,778.38	
Crushing/Proc Equipment	750	267,090.67	
Rough Terrain Forklifts	500	116,378.69	
Rubber Tired Dozers	750	180,887.50	
Rubber Tired Loaders	750	220,232.06	
Excavators	500	106,020.60	
Graders	500	104,092.36	
Off-Highway Tractors/Compactors	750	257,699.59	
Scrapers	730	237,033.33	
	500	145,797.55	
Skid Steer Loaders	120	19,396.44	
Off-Highway Trucks/Water Trucks	1,000	283,370.04	
Other Construction Equipment	500	115,320.65	
Pavers	500	105,798.73	
Surfacing Equipment	750	157,418.36	
Tractors/Loaders/Backhoes			
Trenchers	120	23,463.43	
menuners	500	141,207.16	

Emission factors for CO₂ from (Corps 2009)